THE TEACHING OF MATERIA MEDICA

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THE PLAN OF THE COURSE

Materia medica and pharmacology are subjects which are well nigh protean in their applications. They may be studied from a number of view points, depending on the use the student is to make of the knowledge. The phase of materia medica which interests the pharmacist is of little value to the physician, while the branch of the subject that interests the industrial chemist is of no interest to the nurse. For the nurse, materia media and pharmacology have their own peculiar phases. These subjects must be taught them, then, from their standpoint. Those essentials, only, should be emphasized which have a direct bearing upon nursing. At our institution I have found the following plan of procedure to give the best results. The course is divided into three parts:

(1) A preliminary course in materia medica and pharmacology;

(2) A course on solutions;

(3) A course in general materia medica and pharmacology.

The preliminary course and the course on solutions are given consecutively about the middle of the first year. The general course in materia medica and pharmacology is given throughout the second year.

THE PRELIMINARY COURSE

The preliminary course consists of a series of six didactic lectures which are given in the middle of the first year of training to a class of about thirty pupils and treats the subject in a very elementary fashion. We have found such a course necessary because the pupil nurses serve their first night duty at this time. While on such duty, they frequently have to administer potent remedies, to prepare their doses and handle poisonous drugs. It is essential, therefore, for the nurse to be prepared for this work by an elementary course. She is thus prepared to carry out orders more intelligently and to avoid serious mistakes.

In this elementary course only the very rudiments of materia medica, pharmacy and pharmacology are studied. The course begins with a

general consideration of medicinal substances, their classification, their derivation, their characteristics and their various pharmaceutical preparations. This is followed by a study of active principles, types of action, local effects, general effects, methods of administration, etc. Then a few local remedies, emetics and cathartics are considered; special emphasis being laid upon their administration. Stimulants used in emergency work are now taken up in the following order: caffeine, camphor, digitalis group, adrenalin, atropine, strychnine, etc. Only the effects produced in such emergency use, the preparation of correct doses, methods of administration and toxicological effects should be emphasized from the standpoint of the practical nurse. This is followed by a discussion of anaesthetics, emphasizing especially the preparation for anaesthesia and the after-care of the patient. Hypnotics are then studied; stress being laid upon the various methods and time of administration. The importance of their use only when general nursing measures have failed should be emphasized. One entire lecture is then devoted to morphine which should be discussed rather in detail but in a very rudimentary manner. The course should end with a discussion of antiseptics from a practical point of view.

It should be firmly impressed upon the minds of the pupils throughout the elementary course that all potent remedies should be handled and administered with extreme care. The nurse should be taught from the outset to keep the medicine chest in proper order. Her medicines should be systematically arranged in the closet and the potent remedies kept in a special compartment. I emphasize in almost every lesson the necessity of examining the label of every bottle at least three times before administering its contents. In the calculation and measurement of a dose of medicine she should be taught to verify the result of the calculation and the accuracy of her measurement by frequent repetition of the process. She should know the limitation of the dosage so as to be able to detect an error of this kind. These latter points should be thoroughly emphasized by frequent repetition until care and precision in the handling of drugs become the nurse's second nature.

In the study of the pharmacology of the drugs considered in the elementary course the practical effects of the substances as they occur on the actual patients to whom such remedies are usually given should be emphasized. Special attention, too, should be given to the possible toxicological effects. The detailed study of the preparations, the pharmacy, the pharmacology and administration of the drugs studied, as well as of those not included in this course, should be left for the more extended course to be given in the second year.

THE TEACHING OF SOLUTIONS

It is generally agreed that the subject of solutions properly belongs to the domain of materia medica. Solutions have always been the stumbling block of teacher and pupil alike. On the pupil's part this is largely due to the fact that by the time she enters the training school she has become estranged from the principles of elementary arithmetic. The teacher's difficulty, however, has been the lack of a systematic arrangement of the subject and the absence of simple methods. The study of solutions should be preceded by such principles of arithmetic and elementary algebra as enter into the calculation of solution problems. In my experience I have found the following arithmetical principles to be those generally applied in the calculation of solutions:

(1) The addition, subtraction, multiplication and division of fractions;

(2) The determination of the least common denominator;

(3) Decimals;

(4) The principles of proportion.

Before taking up the study of solutions proper, the class should be thoroughly drilled in these principles until they can solve with the greatest ease all problems which involve such principles.

Solutions are best studied in a laboratory especially equipped for such work. Thus the pupils may be taught every practical detail in the actual preparation of solutions, the preparation of doses of medicine, as well as the actual calculations involved. The course on solutions should also include a study of the principles of physical chemistry governing solutions, as well as the biological principles governing absorption, excretion, etc.

The study of solutions should begin with the consideration of the systems of weights and measures; both the apothecaries' and the metric. It is especially important to thoroughly familiarize the pupils with the metric system. This system is now official in this country as well as throughout the world and it has the advantage of simplicity and uniformity. Many pupils frequently find considerable difficulty in thoroughly understanding the method. I believe this is due to the manner in which the subject is usually taught. The student should not be suddenly confronted with the practical metric units of weights and measures which are used in medicine and pharmacy. It is better to gradually develop these units by a preliminary consideration of the units for measuring length, surface, volume, etc. The pupil is thus taught to visualize the practical units as actual tangible weights and measures. I have found the chart of metric weights and measures

published by the Department of Commerce in Washington a very valuable aid in teaching the system. The study of the metric system should be supplemented by a study in the methods for translating metric doses into their apothecaries' equivalents and vice versa.

We should now test the ease with which the pupil nurses are able to read metric and apothecaries' quantities, their facility in reading such doses properly and their ability to correctly translate doses from one system into the other.

The pupil is now advantageously prepared to study solutions proper and the various methods for their preparation. The study should begin with definitions, types of solutions, nomenclature, saturation, supersaturation, etc. This should be followed by a study of various methods of preparation. At our institution I have obtained excellent results by dividing all solutions into the two following groups:

(1) Solutions for external use.

(2) The preparation of doses for hypodermic or internal use.

In preparing external solutions I believe the method based on proportion to be the easiest and simplest. These methods give the pupil a concrete idea of the relation of the solute and the solvent. Before taking up the rule to be applied in each case the underlying principles should first be studied and then the rule gradually developed from these principles. I believe all problems in solutions and the calculation of doses should be solved by means of pencil and paper. It is so important to avoid mistakes and to obtain the correct results that the solving of the problem should not be left to the uncertainty of mental calculation.

The method consists of writing the problem in the form of a proportion, representing the unknown quantity by X; then of multiplying both means and both extremes and, since both products are equal (according to the rules of proportion), we determine the value of the X. The external solution should be taken up in the following order:

(1) Solutions made from stock tablets;

(2) Solutions made from stock powders;

(3) Solutions made from stock solutions.

SOLUTIONS MADE FROM STOCK TABLETS

For example, take a problem where the nurse is required to prepare 1:5000 solution when she has 0.5 gm. (grs. viiss) tablets. In how much water is it necessary for her to dissolve such a tablet to prepare such a solution?

By representing the unknown quantity of water by X and express-

ing the known facts of the problem in the form of a proportion, we have:

$$0.5 : X : : 1 : 5000$$

since, whatever be the amount of water to use, the 0.5 gm. tablet must have the same ratio to it as 1:5000.

By multiplying both the means and extremes of the above proportion, and since both products must be equal, we find:

$$X = 2500$$

therefore the 0.5 gm. tablet should be dissolved in 2500 cc. of water.

SOLUTIONS MADE FROM STOCK POWDERS

In a similar manner, we may apply the method of proportion to the preparation of solutions from stock powders. In such problems the quantity of fluid to be made up is definitely known or may be left to the judgment of the nurse. The unknown element in all these problems, however, is the amount of stock substance to be used.

For example, a nurse is required to prepare 500 cc. of a 3 per cent boric acid solution. How much boric acid powder is to be used in making up such a solution?

In this example we represent the unknown quantity of powder to be used by X. We know that whatever be the quantity of powder that this X represents, it will have the same ratio to the 500 cc. of fluid to be prepared, as 3 is to 100, since the required solution is to be a 3 per cent solution. Expressing these facts in the form of a proportion we have:

$$X : 500 : : 3 : 100$$

Multiplying both extremes and both means and since both products are equal,

$$100\,X = 1500$$

therefore

$$X = 15$$

15 gms. of boric acid powder will have to be added to 500 cc. of water to make up a 3 per cent solution.

Frequently the nurse is required to prepare a solution from a stock substance when the amount of solution to be made up is not stated. In such instances she may use her judgment and arbitrarily prepare a quantity of solution sufficient for the particular purpose required. For example, the physician orders an ear to be irrigated with a 3 per

cent boric acid solution and such a solution is not available. The nurse knows from her experience that she will probably need about 500 cc. of such a solution. She may then take 500 cc. as the amount of solution to be prepared, and solve the problem in the manner outlined above. On the other hand, suppose the nurse is ordered to wash out a stomach with a 5 per cent bicarbonate of soda solution. Her experience should teach her that for such a purpose 5 or 6 pints of such a fluid would be necessary. Accordingly she should take 2500 or 3000 cc. as the amount of solution to be prepared, and solve the problem in the manner ontlined.

In teaching the methods of proportion we frequently find that some pupils find it difficult to work with X, the unknown quantity. This is due to the difficulty experienced by many pupils with a limited preliminary education of thinking in abstract terms. We can overcome this obstacle by making the X as tangible as possible.

Suppose we have written a problem in the form of a proportion and we discover that some of the pupils find it difficult to understand. We then rewrite the problem, replacing the X by a diagram of a large bottle containing an unknown quantity of fluid (represented in the diagram by an interrogation mark) in case it is desired to find the amount of fluid to be prepared. Or, if we desire to find a definite quantity of powder to be dissolved in a given amount of water, we replace the X in the proportion, by a diagram of a dish of powder in which the quantity of powder is represented by an interrogation mark. In this way we make the X a tangible substance with an unknown factor which is to be determined.

The following example will illustrate the application of the method: in the instance described above where it is desired to find the quantity of water in which the 0.5 gm. tablet is to be dissolved to prepare a 1:5000 solution. We represent the problem in the form of a proportion thus:

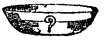
$$0.5 : X : : 1 : 5000,$$

where X represents the unknown quantity of fluid to be used. If the pupils find this difficult to understand, we rewrite the problem in the following way:

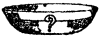
Multiplying both extremes and both the means and since both products are equal, we have:

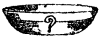
= 2500 cc. which is the amount of fluid contained in the bottle.

Similarly, the problem above described where we desire to know how much boric acid powder is to be used in preparing 500 cc. of a 3 per cent solution. Expressing the problem as a proportion thus, X: 500: : 3: 100, the X representing the quantity of boric acid to be used. Should the pupils find such a problem difficult to understand we rewrite it in the following form, substituting a dish of powder for the X, thus:

 : 500 : : 3 : 100

Multiplying both extremes and both means and since both products are equal we have

100 ×  = 1500

 = 15 gms. which is the amount of boric acid contained in the dish.

SOLUTIONS PREPARED FROM STOCK SOLUTIONS

In preparing a required solution from a stock solution I have devised the following rule which greatly facilitates the calculation of the amount of stock solution to be used:

Multiply the solution required, written as a fraction, by the stock solution, also written as a fraction but inverted, by the number of cubic centimeters to be prepared. The result is the number of cubic centimeters of the stock solution which we are to add to the required amount of water.

This rule is merely the expression of the value of X, the unknown amount of stock solution to use, if the problem is worked out according to the method of proportion. Since the solving of such a problem by the methods of proportion is rather complicated for the average pupil nurse, it is simpler to solve it according to the rule outlined above. In presenting the rule to the class, however, the logical steps by which it is derived should be demonstrated. The pupils are thus enabled to understand it better and nothing is left to the imagination.

The simplicity of the rule and the facility with which it enables us to solve practical problems are readily shown by a study of the following problems:

The nurse is required to prepare 5 pints of a 1: 10000 solution of silver nitrate from a 10 per cent stock solution.

The required solution is 1: 10000; written in the form of a fraction it is $\frac{1}{10000}$

The stock solution is a 10 per cent solution; written in the form of a fraction it is $\frac{10}{100}$ and inverted it is $\frac{100}{10}$

The quantity of solution required is 5 pints or 2500 cc.

According to the rule, multiplying these quantities together in the form described above, we have:

$$\frac{1}{10000} \times \frac{100}{10} \times 2500 = 2.5 \text{ cc.}$$

which is the quantity of 10 per cent silver nitrate solution to be added to 2500 cc. of water in making up a 1: 10000 solution.

(To be continued)